	Document # LAT-MD-01486-01	Date Effective 6 Jan. 2003
	Prepared by(s) Nick Virmani	Supersedes
GLAST LAT SYSTEM SPECIFICATION	Subsystem/Office Calorimeter Subsystem	
Document Title **Calorimeter Subsystem Configuration Management Plan**		

Gamma-ray Large Area Space Telescope (GLAST)

Large Area Telescope (LAT)

Calorimeter Subsystem Configuration Management Plan

DOCUMENT APPROVAL

Prepared by:

	Date
Nick Virmani – Naval Research Lab	

Approved by:

Didier Bédérède, CEA/DAPNIA	Date
Oscar Ferreira, Ecole Polytechnique/IN2P3	Date
Staffan Carius, Univ of Kalmar, Sweden	Date
W. Neil Johnson – Naval Research Lab	Date

CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes	DCN #

TABLE OF CONTENTS

1.0   INTRODUCTION

1.1   Identification

This Configuration Management Plan (CMP) defines the process that will be implemented for the configuration control of hardware developed under the cognizance of the U.S. Naval Research Laboratory's (NRL) and its collaborators and subcontractors for the GLAST LAT Calorimeter (CAL), a major subsystem of the LAT Instrument.

1.2   Purpose and Objective

This plan applies Configuration Management (CM) throughout the development, fabrication, integration, and test phases of the CAL life cycle to provide the following configuration control objectives:

- Establish system baselines,
- Ensure Configuration Control Board (CCB) responsibility,
- Maximize responsiveness and minimize formality,
- Identify items that will be subject to configuration control,
- Provide management flexibility,
- Provide traceability,
- Ensure thorough coordination of proposed changes to the established baseline,
- Provide uniform reporting and documentation, and
- Ensure management visibility of technical changes.

Meeting these objectives provides a program management tool that recognizes the need for change and provides the means to properly implement changes during the GLAST LAT Calorimeter subsystem lifetime. This CMP documents CM practices that, through formal procedures and standard operating practices (SOPs), will provide a uniform system of identification, control, accounting, and verification for the CAL subsystem.

1.3   Scope

This CMP applies to all CAL subassemblies. This includes hardware, software (where applicable), and documentation of subsystems or components, and subassemblies.

- This CMP is not applicable to non-operational CAL engineering related research and development efforts, brassboards, system test beds, algorithms, test fixtures, and special-purpose data analysis systems. Controls and baselines described herein are not always applicable to all CAL project elements. The CAL Subsystem Manager (SM) may grant exceptions on a case-by-case basis.

- This plan applies solely to the NRL's internal developmental efforts and provides a guideline for international partner, co-investigator, and subcontractor CMPs.

- Authority for CM implementation under this CMP is delegated to the international partners, co-investigators, or subcontractors developing and providing individual components unless otherwise specified in the procurement documentation. When developmental projects are controlled by another organization's CCB, they are not controlled by this CMP. The CAL CCB will handle CM of another organization's effort if approved by the CAL SM.

1.4   Authority and Approvals

This document establishes a CAL program CMP developed using the LAT Configuration Management Plan as general guidelines. Under these guidelines, each subsystem manager is chartered to appoint a Configuration Control Manager (CCM) to administer CM duties for that program.

1.5   Calorimeter Subsystem Overview

The calorimeter in a pair-conversion gamma-ray telescope is critical in determining the energy range, energy resolution, and background-rejection capability of the telescope. A calorimeter is typically constructed of a high Z, active detector material, although various passive/active sampling techniques can be employed. The primary tasks of the GLAST calorimeter are to provide an accurate measure of the energy of the shower resulting from pair

conversion of incident gamma rays in the tracker, and to assist with cosmic-ray background rejection through correlation of tracks in the precision silicon tracker with the position of energy deposition in the calorimeter.

To perform these tasks, the calorimeter should have the following properties.

- The calorimeter must have adequate depth to contain most of the energy of the gamma-ray showers. Generally this means that shower maximum must be within the detector.

- The calorimeter must contain a sufficiently high fraction of active detector materials that the total energy measurement is not dominated by "sampling" statistics.

- The energy resolution must be adequate to measure spectral breaks already observed or theoretically predicted from celestial sources.

- The calorimeter must provide some crude imaging capability or physical segmentation to allow the correlation of events in the tracker with energy depositions in the calorimeter.

- The calorimeter should be stable against aging and environmental changes, e.g. temperature and magnetic field variations on orbit. It should be easy to calibrate.

Table 1-1 CAL Subsystem Program Responsibilities

Task	Responsibility			
	Organization	Contact	Telephone	e-mail
Subsystem Manager	NRL	N. Johnson	202-767-6817	johnson@gamma.nrl.navy.mil
Project Manager	NRL/Swales	B. Kraeuter	202-404-1461	rkraeuter@swales.com
System Manager	NRL/Swales	B. Kraeuter	202-404-1461	rkraeuter@swales.com
Electrical Manager	NRL	J. Ampe	202-404-1464	ampe@gamma.nrl.navy.mil
Mechanical Manager	NRL/Swales	P. Dizon	202-404-7193	dizon@ssd5.nrl.navy.mil
Thermal Manager	NRL/Swales	P. Sohn	301-902-4098	psohn@swales.com
S&MA Manufacturing and Reliability Manager	NRL/Swales	N. Virmani	301-902-4344	nvirmani@swales.com
I&T Manager	NRL	E. Grove	202-767-3112	grove@ssd5.nrl.navy.mil

NRL – Naval Research Laboratory

2.0   APPLICABLE DOCUMENTS

The latest issue of the following documents forms a part of this plan to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of the plan, the contents of this plan will be considered a superseding requirement.

2.1   LAT Instrument CAL Subsystem Program Documents

Number	Title
GSFC-433-MAR-001	GLAST LAT Mission Assurance Requirements
LAT-MD-00068	GLAST LAT Configuration Management Plan
LAT-SS-00018	Calorimeter Level III Performance Specification
LAT-SS-00238	LAT - CAL Interface Control Document (ICD)

2.2   Military Standards

Number	Title
MIL-STD-961D	Specification Practices

3.0   ORGANIZATION

3.1   Definitions

CM is defined as a formal adjunct to the GLAST LAT CAL program management approach. CM operates on program levels to meet the requirements of the program sponsor; the requirements of the acquisition and executing agent; and the requirements of vendors, suppliers, and subcontractors (jointly referred to as subcontractors).

3.2   CAL Subsystem Organization

The CAL program organization is shown in Figure 3-1.
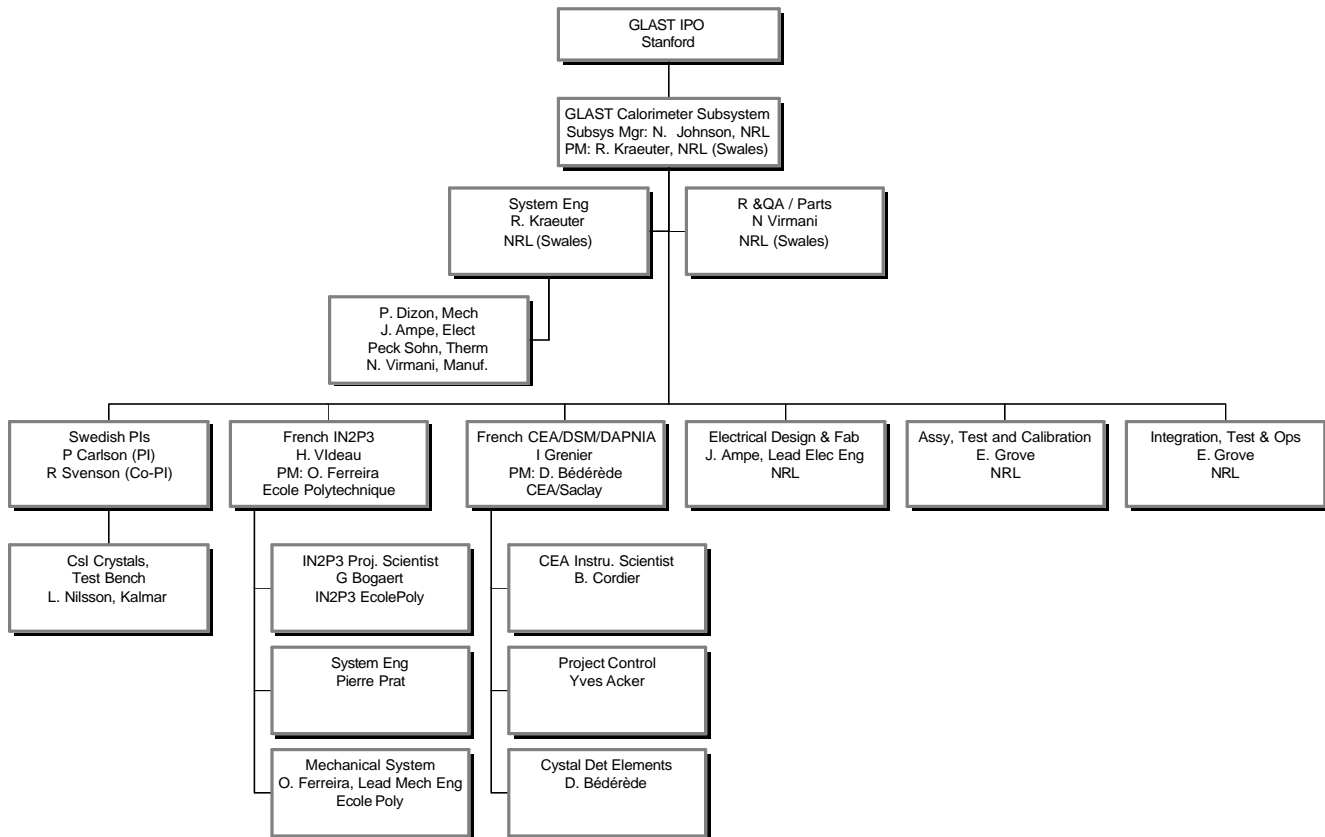
Figure 3-1. CAL Sybsystem Organization

3.3   Configuration Management Office Roles and Responsibilities

The CAL Subsystem Manager (SM) is responsible for the decisions, actions, and directions necessary to ensure that the CM system fulfills the project requirements. The Configuration Management Office (CMO) is responsible for the release of all documentation as identified in Figure 3-2 and for managing the CAL CM activities, which are shown in Figure 3-3.
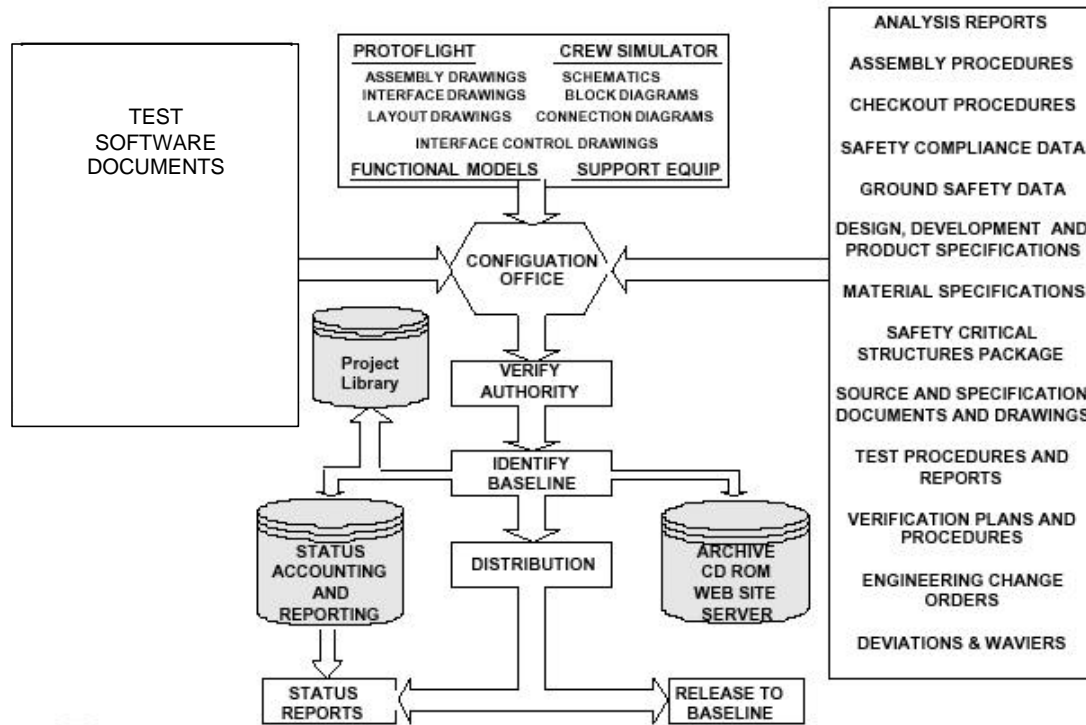
Figure 3-2 Configuration Management Release System

Calorimeter Configuration Management Activities

Identification	Identification	Identification	Identification	Identification
• Hardware • Documentation • Interfaces • Numbering • Baselines	• Change Processing • Change Tracking • CCB/ICCB Admin • Database Maintenance	• Record / Track / Report • Product Die • Hardware • Documents • Action Items • Work Order Authorization • Problem Reports • Status Reports • ECRs, ECOs • Change Packages • Deviations • Waivers • Data Delivery • Interfaces	• Req's Traceability • Technical Reviews • Product / Process Reviews • Audits	• Data Requirements • Distribution • Storage • Archive • Backup • Deliverables • Controlled Doc's • Quality Records

Figure 3-3 Configuration Management Activities

The CMO provides leadership, direction, and support with regard to all CM processes, and is key to the success of the CM process. The CMO is led by the CAL CM Manager who coordinate CM activities with the various developers, collaborators, and subcontractors of the CAL Program.

The CMO is responsible for:

- Establishing detailed change-request procedures and ensuring that all requests for changes are processed properly.

- Making decisions on deployment of changes that affect the form, fit, or function of CAL products under configuration control.

- Providing reports on the status of all Configuration Items (CIs) and proposed changes; and managing changes to all baseline products.

- Developing and maintaining the CM-related plans, policies, and procedures required by the CAL Subsystem Project Office (including the agenda and minutes for the CCB/Internal Configuration Control Board [ICCB] meetings, and change reports),

- Developing and maintaining the Configuration Status Accounting (CSA) System to ensure that the information is accurate and updated on a regular basis.

- Facilitating and endorsing the documentation, implementation, and maintenance of the CM processes.

- Coordinating with team members, Control Boards, and other individuals involved in managing, operating, and maintaining the CAL subsystem project.

- Ensuring that Configuration Identifications, CM library information, and CM-related Configuration Change Notices (CCNs) are updated in the CM system for the organizations they support.

The CM organization is responsible for defining and implementing the CM system for CAL. The following are key CM responsibilities:

- Establishing and maintaining the CAL subsystem Project Library, which contains the test software, hardware, and documentation under CM control. This includes tracking and documenting reception of all software, hardware, and documentation changes and updates; modifications to system manuals and user guides; and any other pertinent CAL directives, as well as tracking and documenting reception of modification requests and problem reports submitted to the CCB/ICCB.

- Maintaining effective controls on hardware and test software from the definition of requirements through implementation, maintenance, documentation, and problem reporting.

- Maintaining effective controls on CAL System Components, which include project specifications, system software, system data, system manuals, and user documentation, and version-tracking mechanisms.

- Maintaining the Level II (Program Level) CCB Interface, which includes receiving feedback from the Level II CCB representative(s) regarding system change directives.

- Functioning as the Data Review Board, which is responsible for reviewing all change evaluation requests for updates to the CAL Data Requirements and supporting documents, and for distributing all review, impact, and disposition requests.

- Functioning as the CAL Change Control Boards (CCB and ICCB), which are responsible for reviewing all change requests for updates to the CAL subsystem, and for distributing all review, impact, and disposition requests.

3.4   Objectives

The CAL subsystem manager requires that this CMP apply through all the CAL subsystem final design, fabrication, integration, test, and flight hardware delivery.

This plan contains the overall policies, principles, objectives, and procedural data to support the evaluation of international partner, co-investigating institution, and subcontractor CM plans and procedures. The SM established appropriate baselines and build standards, starting with configuration identification at the start of development and specific standards for each CAL prototype and production item.

All subsystem and component specifications, ICDs, and other documents are maintained at the SM level.

3.5   Configuration Management Visibility

For all Class I changes, the CMO receives Engineering Change Proposals (ECPs) from the proposing organization. For Class II changes, the CMO receives status reports from the cognizant organization. The following documentation and information will be made available:

- Specifications or other controlling documents or drawings;
- Configuration status reports;
- Individual changes and associated documentation (Class II) on request.

3.6   Responsibilities

The SM and the CCM have overall responsibility for all aspects of CM.

Each participating organization or subcontractor is responsible for the documentation for the component

that they are contracted to build.

Each participating organization or subcontractor shall produce and maintain drawings, documents, and data for the component. The drawings, documents, and data will be delivered along with the final assembly.

3.7   Interactive Access to Digital Data

As a program goal, all data shall be accessible via the LAT CAL project web site at http://heseweb.nrl.navy.mil/glast/.

4.0   CONFIGURATION IDENTIFICATION

4.1   General

Configuration identification consists of setting and maintaining baselines defining the CAL program in terms of each individual CI at any point in time. Depending on the item, different baselines may be progressively established with the project SM approval.

4.2   Configuration Identification (CI)

CIs are identified with the CI specification number as the model number. Table 4-1 provides the identifiers for the CAL subsystem components. These identifiers are used for the CAL Engineering Configuration List (ECL) and As-Built Configuration List (ABCL).

Table 4-1 CAL Components Configuration Item Numbering

Model Number	Nomenclature		Serial Number
	Structure	Engineering Development Model	
		Flight Model	

4.2.1   Interface Control Documents (ICDs)

Interface Control Documents are use to identify, define, document and control the physical, electrical, environmental, and functional requirements, characteristics and constraints that exist at a common boundary between two (2) systems segments/equipment, where system segments/equipment are defined by demarcation of contractual or program responsibilities. The interface control program is designed to promote reliable systematic management of technical control and administrative interface compatibility.

4.2.1.1   Interface Coordination and Control

Interface documentation will be scheduled and developed to support program milestones and contractual requirements. ICD input must contain the detailed interface design of the interfacing system segments. Traceability of interface requirements/parameters is to be maintained via identification on design drawings and an interface document/design matrix. These identifications or notes on design drawings or documents must clearly indicate that the drawing or document contains design parameters that are controlled by ICD, and the drawing or document cannot be changed without approval from the responsible CM function.

CM provides the distribution for review and tracking of interface documents and changes. Systems Engineering is the technical lead and point of contact for initiation of changes to interfaces.

4.2.1.2   Interface Revision Notice

After the Critical Design Review (CDR), the Interface Revision Notices (IRN) will be utilized to maintain interface control documentation. CAL design activities must establish control boards to control their respective internal interfaces.

These boards are chartered by the program level and will be responsive to program direction and will have the authority to establish and control baselines/changes within their delegated authority when the change does not affect a higher-level controlled interface. All contractors including those on grants and sub-contracts of NASA are bound to these Interface Requirements.

4.3   Baseline Management

Baseline management defines the basis for CAL subsystem life cycle process activity and allows reference to, control of, and traceability between CIs.

- Baselines shall be established for the CIs;
- Change control activities shall be followed to develop a derivative baseline from an established one.

4.3.1   Baseline Definition

The SM will employ three (3) baselines from which CAL CM will operate. These are the Functional Baseline, the Allocated Baseline, and the Product Baseline.

4.3.1.1   Functional Baseline

The Functional Baseline was established with the release and acceptance of the LAT Concept Study Report.

4.3.1.2   Allocated Baseline

The Allocated Baseline is established at the PDR and consists of all initially approved documents and specifications that describe each item's functional, interface, and verification requirements. The primary documents forming this baseline are:

- CAL Science Requirements and Instrument Performance Specification;
- CAL-to-LAT ICD; and
- Approved project documents (CMP and PAIP) and the relevant standards (military, commercial, etc.) identified and agreed to at the formal PDR.

After CDR, changes to the Allocated Baseline require CMO approval. All documentation describing the Allocated Baseline shall be placed under configuration control. Changes will be subject to the applicable program or subcontractor change process, which will cover specification requirements and interface aspects.

4.3.1.3   Product Baseline

The Product Baseline for any CAL prototype item will be the confirmation of achievement of the Allocated Baseline performance standards as they become established during the development phase. The Product Baseline provides evidence of production release, a stable design, and product maturity.

4.3.2   Specification Form

Specifications shall be prepared in accordance with the guidelines contained in MIL-STD-961 and MIL-STD-498. In most cases, subcontractor standard practices for documentation will meet the requirements of this paragraph.

A verification matrix shall be included in all of the CAL hardware specifications. The matrix shall provide for the correlation of the performance requirements with the verification requirements.

4.3.3   Engineering Release

An Engineering Release System, shown in Figure 4-1, will be established and maintained to issue configuration documentation to the functional activities (manufacturing, logistics, Quality Assurance, acquisition, etc.) and to authorize the use of configuration documentation associated with the approved configuration. Current and historical engineering release information for all configuration documentation of all CIs and their component parts will be maintained by the CAL CCM.
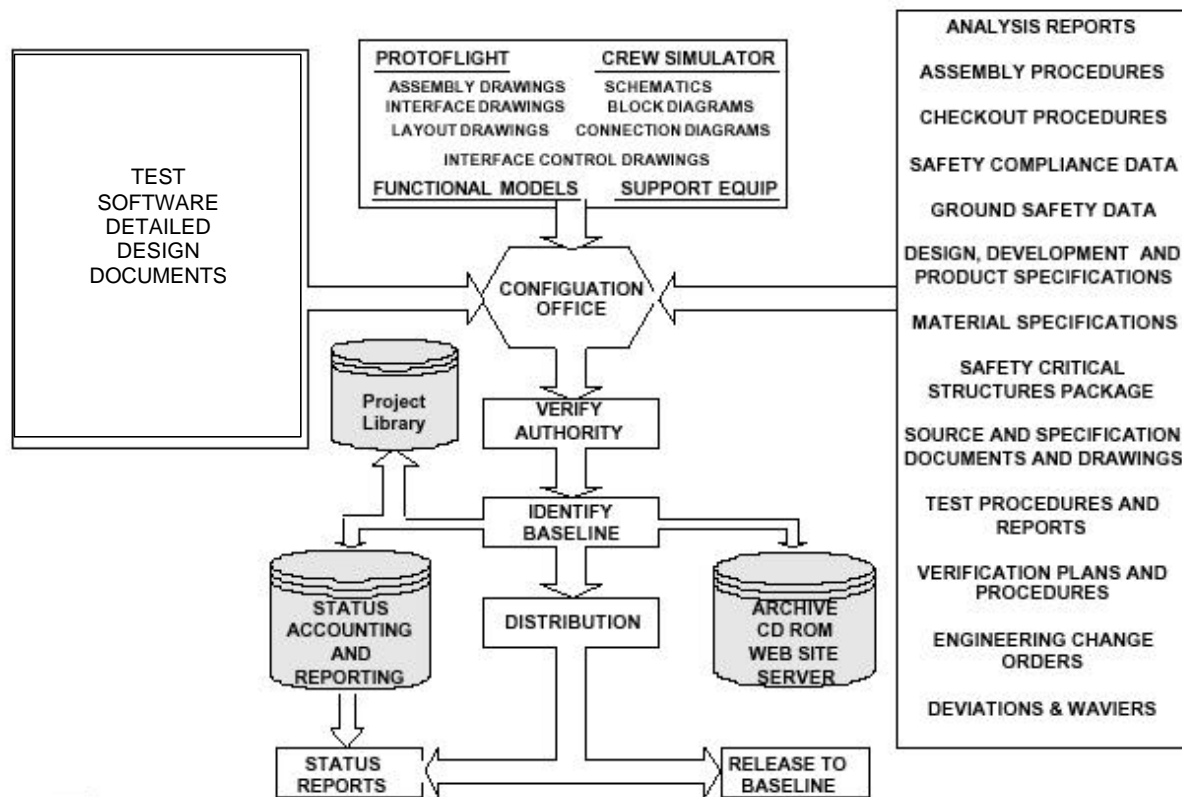
Figure 4-1 Engineering Release System

4.3.4   Drawings Preparation and Control

Drawing preparation, release, and change control shall be according to the requirements specified in this CMP.

Engineering design, engineering assembly drawings, and associated lists will represent the Product Baseline configuration and, therefore, are the basis for configuration control. As a goal, special markings identifying critical interface control points will be applied to engineering drawings. Once baselined as the Product Baseline, all engineering changes will be initiated, processed, and controlled according to the change control requirements of Section 5.0.

4.3.5   Engineering Drawing Release and Change Record System

Engineering drawings and drawing changes are controlled and processed under project control. The Electrical and Mechanical Engineers (ESE and MSE, respectively) and the CCM, as required, shall be responsible for the engineering drawing release process and assigning the cognizant engineers to each drawing for approving release and any subsequent changes. Cognizant engineers for each drawing will be identified on the CAL drawing tree.

The EE and ME will be responsible for engineering release functions including establishing the engineering drawing release and change record system, maintaining accountability, and maintaining current engineering records for each engineering drawing and drawing change.

The Engineering Release and Change Record shall interrelate with CM and the CAL CCB (as needed) to assure that all approved engineering changes are incorporated into the release and configuration change database. Table 4-2 lists key information required on the Engineering Release and Change Record.

16

Table 4-2 Key Engineering Release and Change Record Information

- Drawing number
- Drawing title
- Number of sheets
- Date of release
- Drawing and change letters
- Date of drawing change
- Highest approved CCN
- All approved, disapproved, and pending CCNs not incorporated
- Next assembly part number
- Quantity per next assembly or reference designation

4.3.6   Engineering Configuration List (ECL)

The ECL communicates engineering requirements to the participating organizations and to the subcontractors. The release and change record database is updated as required and the ECL is made available to all local and remote users using the Internet. The primary ECL user organizations are Manufacturing and Quality Assurance.

Manufacturing and engineering initiates the manufacturing traveler/work order authorization, the subassembly logbook, and assembly procedure based on the ECL records. Quality Engineering generates the computerized ABCL by transferring the ECL database into the ABCL file at the completion of each serialized component and subassembly. The ECL and ABCL are also updated upon receipt of major items and their respective as-built drawing packages.

5.0   CONFIGURATION CONTROL

5.1   General

This section outlines a methodology to avoid the possibility of a change being implemented without due consideration of its effect on the baselines, including performance, cost, schedule, logistics, or interfaces with any associated international partner, co-investigating organization, or subcontractor.

Configuration control addresses the evaluation of all CCNs and ECPs, along with their subsequent approval and disapproval actions. Each participating organization or subcontractor shall appoint a Configuration Manager who will be responsible for CAL subsystem and components. The authority required to make a decision on a change varies with the magnitude and nature of the proposed change and may involve several levels within the participating organization or subcontractor organization. To enable the CM process to operate correctly, specific procedures are established to assess changes, including:

- Providing the relevant information for the best decision on a proposed change;
- Implementing decisions; and
- Reviewing and controlling changes in accordance with established rules and involving the use of CCBs at the participating organization or subcontractor facilities, as needed.

5.2   Change Processes

5.2.1   Engineering Release Notice

The ERN is the primary mechanism for releasing documents. Figure 5-1 shows a sample ERN.

Program		Engineering Release Notice			Date		ERN No.	
Item No.	Document No.	Nomenclature			Rev.	Date	Level	Class

Type of Release: FULL   PROJECT

Prepared By:	Subsystem Mgr:	Test Eng:	S/W Eng:	Mechanical:	Stress:	Electrical:
Date	Date	Date	Date	Date	Date	Date

| Quality Eng:	CEA:	System Eng:		CM Mgr:	PM:	IN2P3:
Date	Date	Date		Date	Date	Date

Figure 5-1 Sample ERN

18

5.2.2   Initial Releases

ERNs for CAL documents are prepared and maintained by the CAL CCM or designee.

Signature authority for document approval and release shall be determined by the NRLCCM. Signature authority for drawing approval and release shall be determined on a case by case basis. The electrical and mechanical engineers shall identify the cognizant engineers required for drawing approval, release, and changes. Quality must sign off on all drawings.

All document release and change approval requires authorization by the CAL SM and CCM. The SM can delegate this approval authority to one or more of the CCB members, such as the Electrical and Mechanical Engineers, at any time and for any duration.

For major changes with potential cost or schedule impact, the SM or CCM can convene a CCB meeting to review the proposed changes. If the SM requires review, comment, and concurrence by other CCB members, this review can be coordinated by the CCM and the CCB need not be convened. Figure 5-3 presents the hierarchy for initial releases.
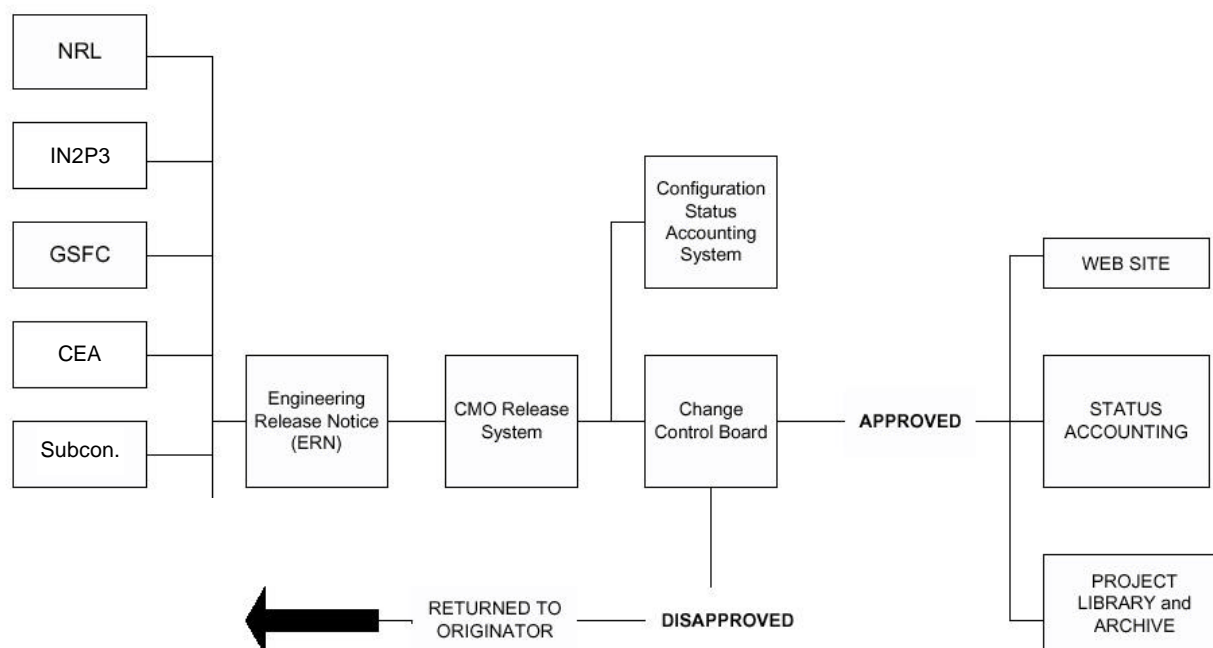
Figure 5-2 Initial Release System

5.2.3   Change Initiation Flow Process

Any Program/Project team members or end-users may initiate a CCN. Electronic CCN forms will be provided by the CAL CMO. Upon initiation, the CCN is forwarded to the CMO for classification and evaluation. The CAL development team accomplishes their responsibilities in the change control process by identifying technical requirements for baselining, proposing changes, and ensuring the implementation of CCNs as identified in the flow process depicted in Figure 5-3.
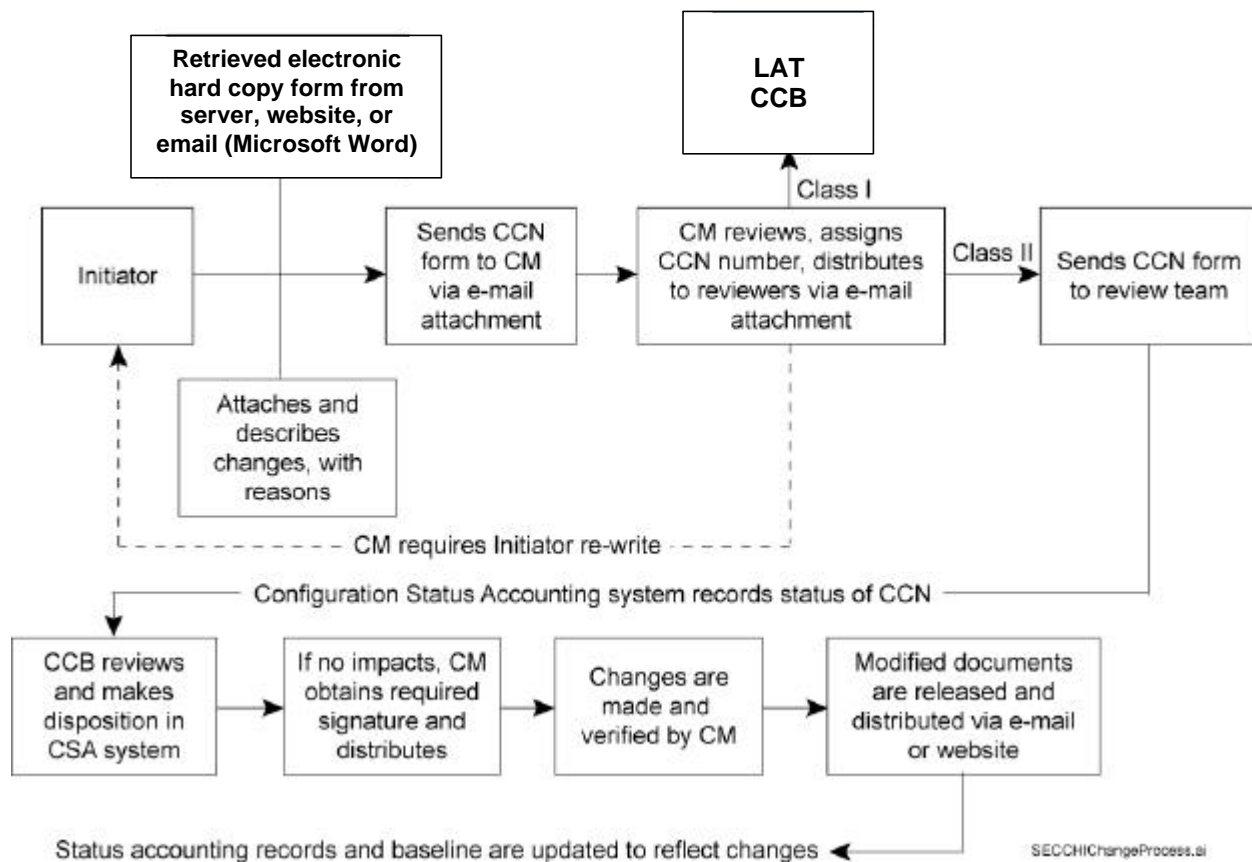
Figure 5-3 CAL Change Control Process

5.2.4   Change Control Processes

CCNs for all CAL documents are prepared and maintained by the CAL CCM or designee. The CAL CCM, or designee, is responsible for:

- generating, reviewing, approving, recording, processing, and maintaining changes to documents;
- distributing CCNs to participating organizations, subcontractors, and NRL personnel for review and approval;
- preparing and distributing the meeting agenda for CCBs, convening CCB meetings, and issuing meeting minutes;
- compiling, updating, and issuing Change Status Lists (CSLs); and
- distributing the approved CCNs.

CCNs for CAL drawings may be prepared and maintained by the either IN2P3, CEA, NRL, or their designees. IN2P3, CEA, NRL, or their designees, are responsible for generating, reviewing, approving, recording, processing, and maintaining changes to drawings and ensuring that those changes are implemented.

5.2.5   Configuration Control Board

The CCB shall be formed following the CAL CDR and will consist of the members shown in Figure 5-4. The CCB can be convened as needed by the either the CAL subsystem Manager or the CCM.

```
                    ┌─────────────────────┐
                    │ Configuration Control│
                    │   Board Chairman    │
                    └─────────────────────┘
```

| Electrical System Manager | Mechanical System Manager | Systems Engineer | Quality Assurance Manager | Configuration Control Manager |

| IN2P3 | CEA | Subcontractor | LAT | GSFC |
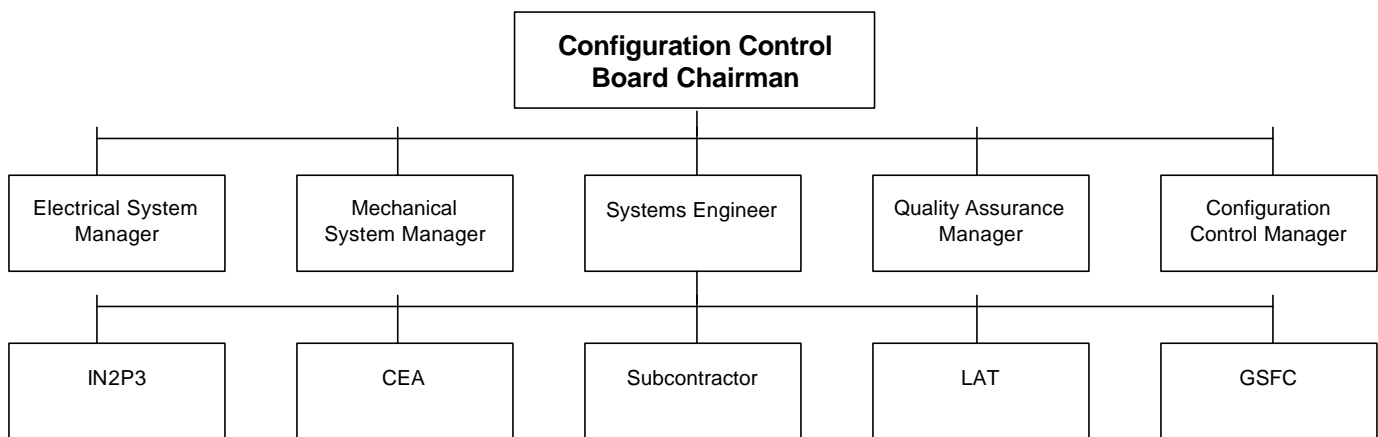
Figure 5-4 Configuration Control Board

5.2.6   Material Review Board

A Material Review Board (MRB) shall be formed before establishing a Product Baseline. The MRB will review and disposition all class 1 non-conformances and discrepancies. The MRB members required to disposition a class 1 Non-conforming Material Report (NMR/problem report converted into material review board report) are shown in Table 5-1.

For a piece part level NMR/PR/MRB, the subsystem engineer and Quality Assurance Manager are responsible for determining which other signatures are necessary, if any, and adding them. For a system-level NMR/PR, the Integration and Test (I&T) lead and Quality Assurance Manager are responsible for determining which other signatures are necessary, if any, and adding them.

The MRB members required to disposition a Problem Report (PR) for class 1 type discrepancy are shown in Table 5-1. The Electrical or Mechanical and Quality Assurance Managers are responsible for determining which other signatures are necessary, if any, and adding them. These dispositions can be accomplished either by convening an MRB meeting or by each member signing off separately.

Table 5-1 Minimum MRB Members

Members needed for disposition of an NMR/ PR converted into MRB report:
• Appropriate subsystem engineer
• Quality Assurance
• I&T lead (only required at the discretion of Quality Assurance)
• Electrical or Mechanical (as applicable)
Members needed for disposition of a PR:
• Appropriate subsystem engineer
• Quality Assurance
• I&T lead
• Electrical or Mechanical (as applicable)

5.2.7   Participating International Organization, Subcontractor, and NRL CAL Interface Control

An important part of change control is the interface between or among participating organizations, subcontractors, and NRL. To control these interfaces, the originator of a proposed change will forward the proposed change to the CAL CCM. The CAL CCM will generate the ERN, CCN, or other appropriate documentation and distribute it to all affected parties for review and approval.

21

5.3   Engineering Change Proposal Classification

Change categorization falls into either "Class I" or "Class II" change status.

Class I changes shall always be subject to the formal change process, i.e., CCN, and require SM/LAT PM approval. Class II changes are subject to the formal change process but may be approved by the Electrical or Mechanical Engineers, along with Quality Assurance. The originator of an CCN/ECP to a CI will classify the changes as Class I or Class II. Classification disagreements shall be referred to the SM for final decision.

5.3.1   Change Classification

Changes to CAL subsystem are classified according to a.) the impact the change will have at the project level and b.) the approval authority needed to proceed with the change. A change that affects the system level requirements, external interfaces, system cost, and/or schedule is considered a Class I change. Class I changes, including deviations, waivers, and MRBs, require LAT PM approval.

A change that affects the interfaces between CIs and the allocation of functions to CIs, or affects component-level cost and/or schedule are considered Class II changes. Class II changes are approved by the ICCB.

5.3.1.1   Class I Changes

A proposed change to a CAL subsystem CI or Test Software will be determined to be Class I change if the CI is affected to the extent that any of the following requirements would be outside the specified limits or specific tolerances.

- Hardware
- Performance
- Weight, balance, moment or inertia, size
- Interface
- Interchangeability
- Safety
- Electromagnetic characteristics
- Cost and Schedule
- Reliability
- Retrofit of accepted items
- Power Requirements
- Configuration of delivered hardware or software, where applicable
- Compatibility with Ground Support Equipment (GSE), Facilities, or Trainers
- Procurement Specification, Design Specifications, Source Control Drawings (SCDs), Interface documents
- Contract Provisions
- Configuration of hardware
- Government Furnished Hardware
- Critical Processes and Procedures
- Electrical, Electronic, and Electromechanical (EEE) Parts List
- Operational Software after Acceptance Review

5.3.1.2   Class II Changes

A Class II change does not require NRL CAL subsystem CCB review unless it is written against CM-controlled documents. Class II changes include any change that does not fall within the definition of a Class II change. Examples of Class II changes are:

- a change in documentation only (such as correction of errors, addition of clarifying notes or views);

- a minor change in hardware (such as substitution with an approved alternative material) that does not affect any item listed under Class I changes; and

- drawing changes that do not affect a baseline or interface.

5.3.2   Change Processing

5.3.2.1   Class I Change Processing

Class I change processing shall be performed through the submission of the formal CCN, which identifies the appropriate changes to the document or drawing. One-step change processing shall apply to changes in the subsystem specification(s) when an approved change to a development specification impacts the subsystem specification. One-step change processing shall be used for changes in the Allocated Baseline(s) when changes are of a minor nature to accomplish expansions or refinements, such as the elimination of items listed as TBD (to be determined).

5.3.2.2   Class II Change Processing

Class II changes usually do not require approval by the SM prior to implementation. Class II changes are documented using the first page of the CCN form.

a. *Class II Change Report Applicability:* A Class II CCN may address both development and interface requirements specifications or a product specification. A Class II CCN may be used to maintain any document if directed by the SM.

b. *Reporting Class II Changes:* Class II changes may be reported to the SM, if requested. Class II changes may also be included in CCNs issued to incorporate Class I changes. The CCN shall indicate the classification of each change specified therein.

5.3.2.3   Urgent or Emergency Change Procedures

5.3.2.3.1   General

The participating organization or subcontractor shall have procedures for implementing urgent (or emergency) changes without the delay caused by the normal change procedure. These changes must still be subjected to the qualification procedures approved by the appropriate NRL CAL representatives and adequate supporting evidence for the change will be necessary in each case. An urgent priority will be assigned to an engineering change proposed for any of the following reasons:

- To correct a potentially hazardous condition, the uncorrected existence of which could result in injury to personnel or damage to equipment (a potentially hazardous condition compromises safety and embodies risk but, within reasonable limits, permits continued use of the affected item provided the operator has been informed of the hazard and appropriate precautions have been defined and distributed to the user); or

- To meet significant contractual requirements (e.g., when lead time will necessitate slipping approved production or deployment schedules if the change is not incorporated); or

- To effect an interface change that, if delayed, would cause a schedule slippage or increase cost; or

- To effect a significant net life cycle cost savings to the government, as defined in the contract, through value engineering or through other cost reduction efforts in which expedited processing of the change will be a major factor in realizing lower costs; or

- To correct unusable output critical to mission accomplishment; or

- To correct critical configuration item files that are being degraded; or

- To effect a change in operational characteristics to implement a new or changed regulatory requirement with stringent completion date requirements issued by an authority higher than that of the functional proponent.

5.3.2.3.2   Processing

a. *Urgent:* The CCB convenes and acts upon the CCN within one (1) week of receipt.

b. *Emergency:* The CCB Chairman calls a special CCB meeting or consults with CCB members and acts upon the CCN within 24 hours of receipt.

5.3.3   Configuration Status Report

The Configuration Status Report (CSR) is the CAL CCM's method of collecting, recording, processing, and maintaining the data necessary to provide program status information to members of the CAL design and development organization.

5.3.4   Deviations and Waivers

Where a drawing or specification is correct and a manufacturing error(s) occurs, a form for Deviations and Waivers is completed by the manufacturer to enable the item to be accepted or for some form of repair to be made in order that the component not be scrapped just because it does not exactly conform to the drawing or specifications. Deviations and waivers should not be used to avoid processes required by the life cycle. If non-applicable documents and evaluations are required, they must be tailored and agreed to prior to contract let.

a. A Request for Deviation (RFD) is a specific written authorization, granted *prior to* the manufacture or testing of an item, to depart from a particular performance or design requirement of a specification, drawing, or document. RFDs are classified as Class I changes and undergo the same approval routing as configuration changes. Items shall not be delivered incorporating a known departure from documentation unless an RFD has been approved.

b. A Request for Waiver (RFW) is a specific written authorization, granted *after* the manufacture or testing of an item, to depart from a particular performance or design requirement of a specification, drawing, or other document, but is considered suitable for use "as is." RFWs are classified as Class I changes and undergo the same approval routing as configuration changes. An item that through error during manufacture does not conform to the specified configuration documentation shall not be delivered to the NRL unless an RFW has been processed and granted.

6.0   CONFIGURATION STATUS ACCOUNTING

6.1   Data Management

The CAL SM will maintain primary responsibility for document development, archiving, change control, and distribution. The CAL web site will support the development, archiving, distribution, change control, status accounting, and baseline management of CAL documentation. The web site is available at http://heseweb.nrl.navy.mil/glast/.

All drawings and specifications used for hardware procurement, fabrication, assembly, and testing will also be released and placed under configuration control and managed by NRL, IN2P3, CEA, and/or the CCM.

The released records will be stored and tracked electronically using standard database practices. Only authorized CM personnel will have authority to update the database.

6.1.1   Standard Reports

The following reports will be available from the CAL website database:

a. *Configuration Status Report*

b. *Engineering Configuration List*

c. *As-Built Configuration List:* A serialized list of assemblies and subassemblies in the CAL subsystem and supporting elements.

6.2   Change Documentation

To ensure configuration visibility, data/documentation exchange will be carried out for all changes, from initial ERN and CCN submittal to final disposition. Copies of all approved ERNs, documents, their revisions, and approved CCNs will be provided to all associated parties.

6.2.1   Exchange of Drawings and Specifications

All CAL engineering drawings, specifications, ICDs, Test Plans, and Test Procedures (including subsequent changes) will be in an electronic format to allow interchange within the project.

As a goal, all documentation will be electronically interchangeable among the participating organizations using Microsoft Word (.doc) or Adobe Portable Document Format (.pdf) data files. The documents shall also be able to be reproduced in paper format.

All engineering drawings, documents, plans, procedures, and associated lists will be delivered to the CAL SM as part of the "as-built" data package. These data packages will be reviewed and approved by quality.

6.2.2   Specification and Document Revisions

A specification or contractually deliverable document shall not be revised without approval of the SM. The specification or document shall not contain information from any CCNs that have not been approved.

A revision is defined as a re-issue of a specification with all of the CCNs since the last issue (or original issue) incorporated in the revised specification or deliverable document.

The superseded specification or document shall be retained intact with all change pages and CCNs to provide traceability and continuity of all previous changes.

7.0   SUBCONTRACTOR AND COLLABORATOR'S CONTROL

7.1   General Subcontractor Control

The CAL SM will implement control of the design, development, and production of all spaceflight CIs using a CAL Science Requirements and LAT Instrument Performance Specification or SOW. These documents define all pertinent design, development, test, and production requirements, including the interface control requirements. The participating organization or subcontractor is obligated to meet the requirements for these controlling documents, including the interface, schematic, and envelope requirement drawings contained or referenced therein.

7.2   Change Control Procedures for Spaceflight Specifications and Drawings

If document or drawing changes are contractually imposed on the subcontractor by the SM, these will be incorporated as Contract Change Notices.

Hardware delivered by the subcontractor shall be identified by the CAL Subsystem Specification, along with the most recently approved CCN number. Each procured unit will be subjected to a formal buy-off (at a minimum), and possibly a source inspection and/or receiving inspection, to assure compliance with the specified requirements.

The SM will normally accept the participating organization's and subcontractor's Change Control Procedures for spaceflight equipment and components if they meet the general guidelines of this CMP.

- Changes shall be proposed by the supplier or subcontractor on an ECP, or in response to a CCN from the CCM, ESE, or MSE.

- All changes to supplier-generated documentation shall be controlled by the supplier or subcontractor.

- All changes, deviations, and waivers shall be recorded and kept for traceability purposes.

7.3   General Supplier Control

Special CM and configuration control requirements may be imposed on CAL participating organizations and subcontractors on a selective basis based on the criticality of item being procured. Those items designated as "Spaceflight" components (i.e., critical spaceflight items) may be subject to special configuration control requirements as directed by the SM.

7.3.1   Spaceflight Parts, Subassemblies, and Components

Specific CM requirements may be imposed on spaceflight parts, subassemblies, and components by means of a CM clause attached to the procurement documentation. The responsibility for imposition of these requirements resides with the responsible design engineer.

If invoked, a CM clause will require the subcontractor to maintain configuration control during the design and manufacture of the items being ordered, as well as provide advanced notice of proposed changes prior to implementation of the change.

Spaceflight items procured directly by the SM or its subcontractors are usually controlled by a specification that defines the pertinent design, test, and production requirements including any interface requirements. The subcontractor is obligated to meet the requirements of this controlling document.

Normally, specification change control is maintained by the CCM for all changes. The subcontractor shall maintain control of all parts, subassemblies, and components using internal CM practices and procedures. A Certificate of Conformance is required to be included with each shipment along with an ABCL of all drawings at the time of item buy-off.

7.3.2   Non-Spaceflight Commercial Off-the Shelf Parts

No unique CM, configuration control, or part number control shall be invoked when purchasing commercial off-the-shelf (COTS) parts or components, unless invoked by the SM. All COTS items are procured by purchase order specifying as a minimum (i) the supplier; (ii) the device part number; and (iii) quantity. COTS suppliers are not obligated to notify the SM or subcontractors in advance of any future part number or configuration change. However, specific purchase orders may preclude vendor part

number changes on the quantity being procured on a given purchase order without notification.

Should a COTS component requirement become critical, a unique specification or SCD will be created for procurement of that item. All critical COTS items for which a specification or SCD has been developed shall be inspected for conformance to specification.

8.0   PROGRAM PHASING

8.1   Establishment of the Configuration Control Board

The structure of the CCB is defined in Section 5.2.5. The CCB will be established following the CAL CDR. The CCB will be convened as deemed necessary by the CAL SM or CCM.

a.   *Project CCB:* All configuration items and their specifications and design documents will be identified and all changes tracked from their initial issue.

b.   *Subcontractor's CCB:* Participating organization and subcontractor CCBs will control the documentation prepared during development that is needed for evidence of compliance with contractually identified standards.

9.0   CONFIGURATION AUDITS AND PRODUCT BUY-OFFS

9.1   General

Configuration verification audits for each HWCI will be performed at major system milestones called "turnover points" or product "buy-offs." The objective of these audits is to verify the "as-built" configuration of the product for acceptance and transition to integration and test with the entire system. These audits also provide assurance of design integrity to support the product during operational use.

Responsibility for the audits/buy-offs resides with the cognizant electrical or mechanical engineer (depending on the item), the Quality Engineer, and the CCM, all of whom operate under the authority of the CAL SM with support from the following entities:

- Subsystem leads;

- Product Assurance Representative

- International and co-investigator partners, where applicable.

The buy-offs shall include an examination of the SPS, planning and manufacturing data, released and "as-built" engineering drawings and data, and quality evaluation records for the specific HWCIs to ensure that the technical documentation accurately reflects the actual functional characteristics of a CI and conforms to the necessary interface characteristics. Test and evaluation data will also be examined to verify the CI has achieved the performance specified in the relevant specification documentation.

As a goal, all audits/buy-offs of components will take place at the cognizant developing organization or subcontractor's facility.

Intermediate audits may be conducted as directed by the SM.

10.0 SOFTWARE CONFIGURATION MANAGEMENT

10.1   Software Configuration Items

The following items will form the basis of the set of Software Configuration Items (SWCIs) and will be documented in the ECL:

- Software Requirements Specification (SRS)
- Software ICD
- Version Description Document (VDD)
- Source Code Listings
- Test plans, procedures, and reports
- Executable software
- Database description

10.2   Configuration Control

The CCM shall maintain an ECL of the project's CSCIs. There will be a single copy of the ECL. Changes become official only after they appear on the ECL.

10.3   Control of Software

Approval of Class I changes to the agreed and established software Functional, Allocated, and Product Baselines will be performed through the change process defined in Section 5.0.

10.4   Software Backups

The following safeguards have been established to protect the integrity and availability of the controlled software. Routine automated / full tape backups will be performed at x intervals. Backup copies of the controlled software will be maintained locally on project networks in the event of system crashes or similar incidents. Additional backup copies of the controlled software will be stored off-site at the following location(s): Off-site copies will be uploaded to the off-site storage location at x intervals via (mode of transmission).

11.0 NOTES

This section contains non-mandatory information provided for clarification.

11.1 Intended Use

This CMP shall be used to establish uniform CM practices for all CAL systems, subsystems, components or CIs, and supporting items being acquired, procured, or developed. The primary intention of this CMP is to provide information on NRL's CM policy and methods to be implemented for the CAL program.

11.2 Changes from Previous Issue

When this document is revised, notes as to the changes will be identified in the Record of Changes.

11.3 CMP Tailoring

This CMP reflects the current CM program for CAL. Should additions to, or enhancements to the CM requirements be necessary, this CM plan may be modified accordingly. Requests to amend this existing program must be made in writing to the CAL SM. All amendments will be by SM approval, and will result in a document revision.

11.4 Acronyms and Abbreviations

Lists of abbreviations and acronyms used in this document are provided below.

Table 11-1 Acronyms

Acronym	Definition
ABCL	As-Built Configuration List
C&DH	Command and Data Handling
CALS	Continuous Acquisition and Life Cycle Support
CAR	Configuration Accountability Report
CCB	Configuration Control Board
CCM	Configuration Control Manager
CCN	Configuration Change Notice
CDR	Critical Design Review
CI	Configuration Item
CM	Configuration Management
CMO	Configuration Management Office
CMP	Configuration Management Plan
COTS	Commercial Off-the-Shelf
CSA	Configuration Status Accounting
CSCI	Computer Software Configuration Item
CSL	Change Status List; also Centre de Spatial Liege
CSR	Configuration Status Report
doc	Microsoft Word file extension/format
ECL	Engineering Configuration List
ECP	Engineering Change Proposal
EDM	Engineering Development Model
EE	Electrical Engineer
EEE	Electrical, Electronic, and Electromechanical
ERN	Engineering Release Notice
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
HWCI	Hardware Configuration Item
I&T	Integration and Test
ICCB	Internal Configuration Control Board
ICD	Interface Control Document
IRN	Interface Revision Notice
MIL-STD	Military Standard

Acronym	Definition
ME	Mechanical Engineer
MRB	Material Review Board
NMR	Non-conforming Material Report
NRL	U.S. Naval Research Laboratory
PAIP	Product Assurance Implementation Plan
pdf	Adobe Acrobat Portable Document Format
PDR	Preliminary Design Review
PMCB	Parts and Material Control Board
PR	Problem Report
RFD	Request for Deviation
RFW	Request for Waiver
SCD	Source Control Drawing
SCMP	Software Configuration Management Plan
SOP	Standard Operating Practice
SOW	Statement of Work
SM	Subsystem Manager
SRS	Software Requirements Specifications
TBD	To Be Determined